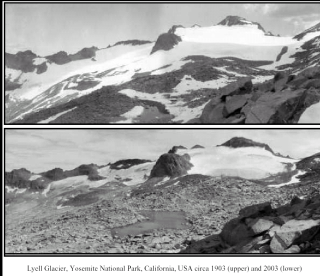


## Adapt, Flee, or Perish



Lassen Glacier, Yosemite National Park, California, USA since 1902 (upper) and 2002 (lower)

J. T. Andrew  
Chief, Department of Water Resources  
Public Health Working Group  
September 14, 2009  
Sacramento, California

## Today's Topics

- Projected impacts to water resources from climate change
- Climate change mitigation in the water sector
- Adaptation to climate change in the water sector
- Climate change and water quality

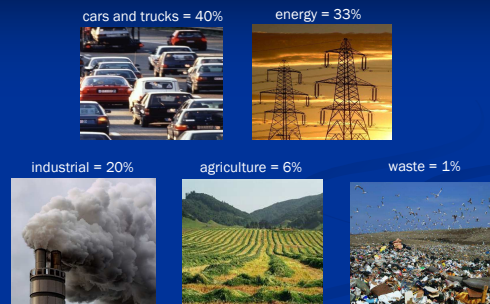


## Climate Change Impacts on California's Water Resources



- Reduced snowpack, impacting water supply and hydropower
- Earlier snowmelt results in increased flood control demand on reservoir space
- Higher water temperatures impacts ecosystem
- Sea level rise impacts the Delta, threatens levees and increases salinity
- Increased demand in all sectors

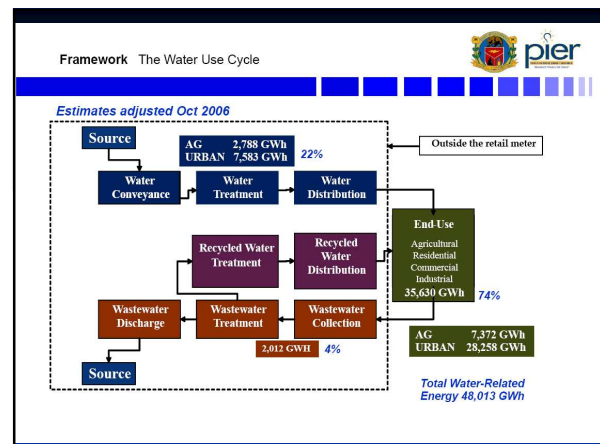
## California's GHG Emissions



## Water, Energy and Climate Change



Future water management activities must carefully consider strategies to reduce greenhouse gas emissions.

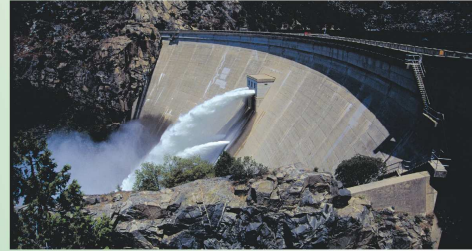


## Governor's Climate Action Team Water-Energy Subgroup

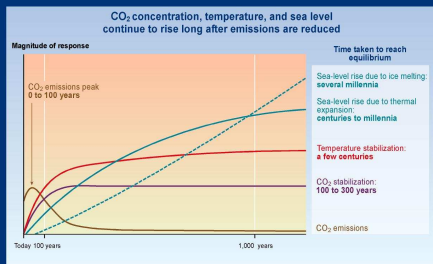


- Water conservation
- Water recycling
- Energy intensity of water systems
- Urban runoff and stormwater reuse
- Renewable energy production

O'Shaughnessy Dam



## Adaptation is a Necessity



IPCC | INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE



Climate Change Water Adaptation White Paper  
[www.climatechange.water.ca.gov](http://www.climatechange.water.ca.gov)



## Comprehensive Strategy for Adaptation

### Regional Strategies

- Fully implement Integrated Regional Water Management (IRWM)
- Aggressively increase water use efficiency



## Comprehensive Strategy for Adaptation

### Statewide Strategies


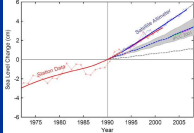
- Practice and promote integrated flood management
- Enhance and sustain ecosystems
- Advance and expand conjunctive management of surface and groundwater resources
- Fix the Delta



**DEPARTMENT OF WATER RESOURCES**

## Comprehensive Strategy for Adaptation

- Improving Management and Decision-Making Capacity
  - Preserve, upgrade, and increase monitoring and data analysis and management
  - Plan for and adapt to sea level rise
  - Identify and fund focused climate change impacts and adaptation research and analysis

**DEPARTMENT OF WATER RESOURCES**

## Comprehensive Strategy for Adaptation


### Investment Strategies

- Provide sustainable funding for statewide and integrated regional water management



California **Water Plan Highlights**

INTEGRATED WATER MANAGEMENT




UPDATING 2009 - DEPARTMENT OF WATER RESOURCES

**Public Review Draft**  
January 26, 2009


[www.waterplan.water.ca.gov](http://www.waterplan.water.ca.gov)

EXECUTIVE SUMMARY  
2009 CALIFORNIA CLIMATE ADAPTATION STRATEGY  
DISCUSSION DRAFT

A Report to the Governor of the State of California  
in Response to Executive Order S-13-2008



**Public Review Draft**



[www.climatechange.gov/adaptation](http://www.climatechange.gov/adaptation)

## Climate Change & Water Quality Direct Effects

**Watershed responses**

- Changes in vegetation, soil moisture, groundwater infiltration, erosion

**Runoff timing**

- Less dilution during the dry season, droughts
- More (and more polluted) runoff during flood season
- Infrastructure damage from flooding

**Influent water quality**

- Changes in temperature, pH, turbidity, dissolved oxygen, nutrients
- Impacts to treatment processes

**Sea level rise/salinity**

- Sacramento-San Joaquin Delta
- Coastal aquifers

## Climate Change & Water Quality Indirect Effects

**Water system operations**

- Flood control
- Fisheries/ecosystem needs
- Recreation
- Ambient water quality

**Alternative water supplies**

- Groundwater
- Recycled water
- Desalination

**Energy use**

- Advanced water treatment technologies
- Treatment plant operations

## California Water Management and Climate Change

- Climate change presents significant challenges for the management of California's water resources.
- California water managers must focus on mitigation and especially adaptation.
- Climate change responses must be thoughtfully integrated with water supply reliability, environmental protection, public safety, and public health actions.
- We must embrace an entirely new way of thinking about water resources planning and management.

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Department of Water Resources  
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jandrew@water.ca.gov



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## Common Energy-Water Tradeoffs

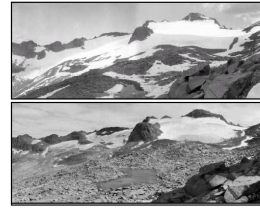
Energy Use	More	Seawater desalting Wastewater reuse Conjunctive use Wastewater treatment Large dam removal Drip irrigation-SW Fish screens	Water treatment Pumping
	Less	Water conservation Crop yield improvements Solar generation agriculture substitution?	Shade trees Evaporative cooling Reforestation Biofuels Production? Shale oil Production?
		Less	More
		Water Use or Environmental Impact	

Jay Lund, UCD

**DRAFT**

California Environmental Protection Agency  
Air Resources Board

### EXPANDED LIST OF EARLY ACTION MEASURES TO REDUCE GREENHOUSE GAS EMISSIONS IN CALIFORNIA RECOMMENDED FOR BOARD CONSIDERATION



Lipit Glacier, Yosemite National Park, California, USA circa 1903 (top) and 2003 (bottom)

SEPTEMBER 2007



## CLIMATE ADAPTATION STRATEGY

- Executive Order S-13-08
- Statewide adaptation plan covering seven sectors:
  - Water
  - Transportation and Energy Infrastructure
  - Forestry
  - Oceans and Coastal Resources
  - Agriculture
  - Biodiversity and Habitat
  - Public Health
- NAS Sea Level Rise Study
- Transportation systems vulnerability assessment